EFFECT OF LOWER LIMB IRRADIATION BY PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON BALANCE IN STROKE PATIENTS

Dissertation submitted in

the Partial fulfillment

for the degree of

MASTER OF PHYSIOTHERAPY

(Neurology)

The TamilNadu Dr. M.G.R. Medical University

Chennai

May 2018

PSG COLLEGE OF PHYSIOTHERAPY

Coimbatore

PSG COLLEGE OF PHYSIOTHERAPY

Coimbatore

CERTIFICATE

This is to certify that the research work entitled **"EFFECT OF LOWER LIMB IRRADIATION BY PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON BALANCE IN STROKE PATIENTS"** was carried out by **Reg. No: 271620242**, of P.S.G College of Physiotherapy, towards partial fulfillment of the requirements of the **MASTER OF PHYSIOTHERAPY (Physiotherapy in Neurology)** degree programme of The TamilNadu Dr. M.G.R Medical University, Chennai.

Internal examiner **External examiner**

Date of evaluation:

PSG COLLEGE OF PHYSIOTHERAPY

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Prof. R. MAHESH, MPT,
Principal
P.S.G. College of Physiotherapy,
Coimbatore - 641 004

Place: Coimbatore
Date:

PSG COLLEGE OF PHYSIOTHERAPY

Coimbatore

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Prof. Dr. R. BALAKRISHNAN, MD, DM
(NEUROLOGY), DNB (NEUROLOGY)
Head, Department of Neurology,
PSG Hospitals,
Coimbatore – 641 004.

Place: Coimbatore
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Guide

Prof. R.MAHESH, MPT.,
Principal,
P.S.G. College of Physiotherapy
Coimbatore - 641 004.

Co-Guide

Mrs. P.Sweety Shuba, MPT.,
Lecturer,
P.S.G. College of Physiotherapy
Coimbatore- 641 004.

Place: Coimbatore

Date:

DEDICATED TO MY EVERLOVING PARENTS AND MY SISTER

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ABBREVIATIONS

PNF	-	Proprioceptive Neuromuscular Facilitation
LE	-	Lower Extremity
BBS	-	Berg Balance Scale
FMA-LE	-	Fugl – Meyer Assessment for Lower Extremity
D_1	-	Diagonal pattern 1
MCA	-	Middle Cerebral Artery

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CHAPTER-I

INTRODUCTION

Stroke is a global health problem. It is the second commonest cause of death and fourth leading cause of disability worldwide [2] . Stroke is a leading cause of functional impairments; with 20% of survivors requiring institutional care after 3 months and 15%-30% being permanently disabled [3] . In Indian population stroke is relatively common in young population [Indian population 60years ≥ 7.5% compared to the west (e.g. British population ≥ 65 years)]. The estimated adjusted prevalence rate of stroke range, 84-262/100,000 in rural and 334-424/100,000 in urban areas. The incidence rate is 119-145/100,000 based on the recent population based studies in 2013.

Stroke was defined as *'More than 40 years ago as ' rapid developing clinical signs of focal (or global) disturbances of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin.* ***World Health Organization (WHO) in 2013.***

Stroke or Cerebrovascular accident [CVA] is the sudden loss of neurological function caused by an interruption of the blood flow to the brain. Ischemic stroke is the most common type, affecting about 80% of individuals with stroke, and results when a clot blocks or impairs blood flow, depriving the brain of essential oxygen and nutrients [1]. Balance and gait deficits are commonly observed in this population, leading to reduced ambulatory activity , limitations in activities of daily living and community participation , physical inactivity and subsequent deterioration in quality of life [1] .

Proprioceptive neuromuscular facilitation (PNF) is a concept of treatment widely used in rehabilitation to improve the performance of the neuromusculoskeletal system through the stimulation of muscle and joint proprioceptors. This approach uses either dynamic contractions associated with stretching or isometric contractions. During both types of contractions maximal resistance is commonly applied, although moderate contractions can also be used. The hallmark of the PNF technique is the use of diagonals or spiral movements [2].

One principle of PNF is the force irradiation, which is based on fact that the stimulation of strong and preserved muscles produces activation of the contralateral injured and weak muscles.

Neuromuscular mechanisms, such as proprioception of muscle spindles and Golgi tendon organ, and joint receptors are behind PNF force irradiation. The strength gains of the contralateral untrained homologous muscles are referred to as cross education or cross training. Although the increase of magnitude of muscle activity during cross education is controversial, substantial levels of contraction in the contralateral untrained muscles have been observed. The force irradiation is likely to be one of the mechanisms underlying the cross education phenomenon [2].

The force irradiation effect depends on the abundance of stimulus from the central motor pathways for the muscles in contraction and also of the afferent feedback to the contralateral motor neurons[1]. Consequently, the information received by the rested limbs is probably mediated through the bilateral distribution of the descending motor pathways. The mechanisms underlying the contralateral effects of training are uncertain and may be caused by muscular, neural, spinal cord, cortical and subcortical influence.

PNF is a method used in clinical practice in order to improve development of neuromuscular system by stimulation of muscle and joint proprioceptors . Some concepts characterize the philosophy under the technique: integrated approach (i.e., treatment is directed toward the human as a whole and not only as a body segment), based on an untapped existing potential (mobilizing reserves patients), positive approach (reinforcing patient's ability on a physical and psychological level) whose goal is reaching the level of function from this patient through the International Classification of Functioning (ICF) model [5] .

Gupta. S Hamdani. N et al., 2014 conducted an study on " Effect Of Irradiation By Proprioceptive Neuromuscular Facilitation On Lower Limb Extensor Muscle Force In Adults". Hence , this study was conducted to evaluate the effect of lower limb irradiation by proprioceptive neuromuscular facilitation on lower limb extensor muscle force in normal healthy individuals.

1.1 NEED FOR THE STUDY

Based on available literatures, there are evidences shows that in previous study they have focused irradiation of PNF on lower limb used in stroke population for extensor muscle force in contralateral side. So we need to irradiation of PNF effect used to improve the balance in the stroke population.

1.2 OBJECTIVES

To find out the effectiveness of PNF training on contralateral lower extremity on balance in stroke patients.

1.3 HYPOTHESIS

Null Hypothesis: There will be no significant different in Group A, B & C on balance in stroke patients.

Alternate Hypothesis: There will be significant different in Group A, B & C on balance in stroke patients.

1.4 OPERATIONAL DEFINITIONS

IRRADIATION

Based on PNF in practice Susan S. Adler define 'Irradiation as the spread of the response to stimulation'. This response can be seen as increased facilitation(contraction) or inhibition (relaxation) in the synergistic muscles and patterns of movement. The response increases as the stimuli increase in intensity or duration .It is resistance to motion that produces irradiation, and the spread of the muscular activity will occur in specific patterns[4].

BALANCE

Based on Physical Rehabilitation (6^{th} edition)Susan B. O'Sullivan define 'Balance is the condition in which all the forces acting on the body are balanced such that the center of mass (COM) is within the stability limits, the boundaries of the base of support (BOS). The overall goals of the postural control system, stability and function, are achieved through integrated CNS systems of control'[25].

CHAPTER-II

LITERATURE REVIEW

- **Gupta. S Hamdani. N, et al., 2014** conducted an study on " Effect Of Irradiation By Proprioceptive Neuromuscular Facilitation On Lower Limb Extensor Muscle Force In Adults". 200 subjects were included in this study. All selected subjects were randomly divided into 4 groups, 50 subjects were selected in each groups, according to the PNF pattern applied to them. ($A=D_2$ flexion pattern of contralateral upper limb, $B=D_2$ extension pattern of contralateral upper limb, $C=D_1$ flexion pattern of contralateral lower limb, $D=D_1$ extension pattern of contralateral lower limb). Strain gauge was used; it was attached to subject's non-dominant lower limb to measure its extensor muscle force. In result the maximum voluntary isometric contraction of extension force of non-dominant lower limb improved significantly while performing PNF pattern on dominant lower limb. It was suggested that different protocols and different type of exercise form like isokinetic can be used and can also be used in different neurological conditions like stroke and can be validated [1] .

- **PAN Yu- Jian, et al., 2012** conducted a study on "effect of proprioceptive neuromuscular facilitation on balance in stroke patients". 204 patients in community divided into two groups (control group=98)(observation group= 106). The control group accepted routine rehabilitation and the observation group received PNF additionally. Fugl-Meyer Assessment of Lower Limb, Berg Balance Scale and Static Balance Locator were used to evaluate the motor and balance function before and after 3months after treatment and Concluded that PNF can improve the lower extremities motor and balance function of stroke patients [2] .

- **Luciana Bahia Gontijo, et al., 2012** conducted a study on " Evaluation of Strength and Irradiated Movement Pattern Resulting from Trunk Motions of the Proprioceptive Neuromuscular Facilitation". The study was conducted with 30

sedentary and female volunteers, the PNF motions of trunk flexion, and extension with the foot (right and left) positioned in a developed equipment coupled to the load cell, which measured the strength irradiated in Newton. They Concluded that the distal irradiation in lower limbs became evident, reinforcing the therapeutic actions to the PNF indirect muscular activation[5].

- **Eszter Németh, et al., 2008** conducted a study on "PNF induced irradiation on the contralateral lower extremity with EMG measuring". The study was conducted with 20 healthy physiotherapist students: 15 females and 5 males took part in a single electomyographic measure. They have already known the PNF technique. Flexion PNF pattern was applied on lower extremity to facilitate the muscles on the opposite side. This investigation is based upon a single electromyographic measurement. They concluded that the abduction setting of the unmoved limb and the hip flexion on the moved limb has a significant effect on irradiation. A hip abduction of a lesser degree and a hip flexion of a higher degree induced significantly stronger contralateral muscle activity[8].

- **Paula C. Meningroni, et al., 2009** conducted a study on "Contralateral force irradiation for the activation of tibialis anterior muscle in carriers of Charcot-Marie-Tooth disease: effect of PNF intervention program". The study was conducted with12 patients of both sexes. They were treated twice-weekly for 5 weeks. At each session, they performed the following diagonal patterns: chopping, extension-adduction with internal rotation (EAIR) and flexion-abduction with internal rotation (FAIR). The diagonals were repeated four times, in both upper and lower limbs, with each repetition lasting six seconds on average. During execution, the response of the TA muscle was recorded by a surface electromyography disregarding the initial and final two seconds of each diagonal. The results of this study is the use of a treatment program with PNF diagonals in patients with CMT-1A who have difficulty activating the TA muscle. They concluded the use of a treatment program with PNF diagonals in patients with CMT-1A who have difficulty activating the TA muscle[16].

- **Insuk Park, PT, et al., 2012** conducted a study on " The Effects of Self-induced and Therapist-assisted Lower-limb PNF Pattern Training on the Activation of Contralateral Muscles". The study was conducted with 6 male and 15 female students participated in the experiment; Members of the self-led treadmill exercise group went through three sets of extension, abduction, and internal rotation the lower-limb pattern of PNF training according to a researcher's spoken instructions. The other group went through three sets of the same exercises, receiving direct resistance training from a therapist. A surface EMG was used for measurement, and the average values of three measurements were used for both groups. After the end of this research they concluded that the PNF training on a treadmill can be effective in promoting muscular activation of the contralateral semitendinosus, while therapist-led PNF training promotes muscular activation of the gastrocnemius. Overall, lower-limb PNF pattern training of one side of the body can be an effective treatment method for promoting muscular activation of the opposite side[18].

- **Chao-Chung Lee, et al., 2001** conducted a study on " Effects of proprioceptive neuromuscular facilitation on Balance and mobility performance of individuals with Stroke: a preliminary report **".** The study was conducted with Sixteen outpatients with hemiparesis secondary to stroke participated in this study and were randomly assigned to either the experimental or the control group. Subjects in the experimental group received 30 min PNF treatment twice a week for a total of 12 sessions, while subjects in the control group received conventional treatment for the same amount of duration and frequency as in the experimental group. The Berg Balance Scale, gait speed, steps, limit of stability(LOS), and transfer rate and moving sway during sit-to-stand were measured before and after completing the 12 treatment sessions. After the treatment sessions and concluded the specific and goal oriented PNF approach results in a trend of better improvement than conventional therapy on balance and functional mobility observed in our outpatients with stroke. More subjects is needed to further document its significance[19].

- **Eun-Kyung Kim, et al., 2015** conducted a study on " Effects of aquatic PNF lower extremity patterns on balance and ADL of stroke patients". The study was conducted with Twenty post stroke participants were randomly assigned to an experimental group (n = 10) or a control group (n =10). The experimental group performed lower extremity patterns in an aquatic environment, and the control group performed lower extremity patterns on the ground. Both exercises were conducted for 30 minutes/day, 5 days/week for 6 weeks. Balance was measured with the Berg Balance Scale (BBS), Timed Up and Go Test (TUGT), Functional Reach Test (FRT), and One Leg Stand Test (OLST). Activities of daily living were measured with the Functional Independence Measure (FIM). After 6weeks treatment and Concluded that performing aquatic proprioceptive neuromuscular facilitation patterns in the lower extremity enhances balance and ADL in stroke patients[20].

- **Monara Nunes, et al., 2016** conducted a study on "Motor Irradiation According to the Concept of Proprioceptive Neuromuscular Facilitation: Measurement Tools and Future Prospects". The study was the concept of Proprioceptive Neuromuscular Facilitation among the basic principles, Motor Irradiation (MI) allows to activate weak muscles, by activating strong muscles. Despite being widely used, the neurophysiological basis that justify the Motor Irradiation and its measurement forms are not yet well understood, which motivated us to conduct a review of the databases of Pub Med, Lilacs and Scielo, looking for articles that clarify the subject. The literature emphasizes three possible theories to justify MI, two neural and one biomechanical. There are several ways used to measure the MI, and the Electromyography, Functional magnetic resonance imaging and Load cell are the most cited in studies. Future studies could use the electroencephalography to measure the electrophysiological effects caused by strength irradiation in the Neuromuscular Facilitation Proprioceptive protocols[21].

- **Pink M, et al., 1981** conducted a study on "Contralateral effects of upper extremity proprioceptive neuromuscular facilitation patterns". The study was conducted with Ten right-handed women between the ages of 22 and 34 volunteered for this study. Only female subjects were used so that the therapist could give maximal resistance throughout the range of movement. All subjects had prior training in PNF. None of them had a history of neurological or orthopedic disorders of the upper extremities or trunk. Muscle activity is measured in EMG units. The PNF pattern chosen for the study was flexion, abduction, and external rotation with elbow straight (flexor component) and extension, adduction, and internal rotation with elbow straight (extensor component). This pattern was applied using the technique of slow reversals. The result is the electrical activity in the left non exercised limb was present in all subjects during an upper extremity PNF pattern or resistance to the PNF pattern of the right limb[22].

- **Rosa Abreu, et al., 2015** conducted a study on "Force irradiation effects during upper limb diagonal exercises on contralateral muscle activation". The study was conducted with Thirty healthy subjects (11 males) performed isometric unilateral diagonal exercises based on proprioceptive neuromuscular facilitation technique in an isokinetic dynamometer with their dominant upper limbs. During the exercise the muscle activity of the medial deltoid, pectoralis major and upper trapezius in the non-dominant (non-exercised) upper limbs of the participants was recorded by surface electromyography. In conclusion, they observed that force irradiation during upper limb diagonal exercises is affected by diagonal direction, contraction intensity when performed by healthy participants[23].

CHAPTER-III

MATERIALS AND METHODOLOGY

3.1 MATERIALS:

- Bed
- Knee hammer
- Measuring tape
- Cranial nerve and Sensory examination kit.
- Stop watch

3.2 STUDY DESIGN:

- Prospective Quasi-Experimental Design.

3.3 STUDY SETTING:

Department of Neurology & Department of PMR,PSG hospitals, Coimbatore.

3.4 HUMAN PARTICIPATION PROTECTION:

The study was reviewed and approved by institutional human ethics committee at PSG IMS&R

3.5 POPULATION/PARTICIPANTS:

Participants with hemiplegia from PSG Hospitals were chosen as population for the study. A total of 30 hemiplegic participants were assigned into 3groups.

- **Group A**= 10 patients received contralateral PNF D_1 flexion & extension pattern. (Annexure - vi)
- **Group B**= 10 patients received contralateral PNF D_1 flexion pattern. (Annexure-vi)
- **Group C**= 10 patients received contralateral PNF D_1 extension pattern. (Annexure - vi)

3.6 SAMPLING:

- Simple Random Sampling.

3.7 CRITERIA FOR SAMPLE SELECTION

3.7.1 Inclusion Criteria:

- MCA tertiary involvement.
- First onset of ischemic infarction of less than 1month duration.
- Age – 40 to 65years.
- Able to sit for 30sec on stable surface.
- Mini Mental Score > 23
- Medically stable patients.
- Patients able to understand and follow simple verbal instructions.

3.7.2 Exclusion Criteria:

- Visual field defects.
- Abnormalities in the vestibular organs.
- Other neurological, musculoskeletal and cardiovascular conditions.
- Perceptual disorders.
- Other musculoskeletal conditions (Pain, limited motion or weakness) in the non-paretic lower limb.
- Non cooperative patients.

3.8 STUDY DURATION:-

- Total duration of 8 months was adopted for this study.

3.9 TREATMENT DURATION: -

- **Group A** = Contralateral PNF D_1 flexion &extension pattern. 6 Sessions per week for 2 weeks (45minutes/session). (Annexure - vi)

- **Group B** = Contralateral PNF D_1 flexion pattern. 6 Sessions per week for 2 weeks (45minutes/session). (Annexure - vi)
- **Group C** = Contralateral PNF D_1 extension pattern.6 Sessions per week for 2 weeks (45minutes/session). (Annexure - vi)

3.10 INSTRUMENT & TOOL FOR DATA COLLECTION

- Berg Balance Scale. (Annexure - v)
- Fugl-Meyer Assessment. (Annexure - v)

3.11 TECHNIQUE OF DATA COLLECTION

Initial assessment will be taken on the first day of intervention by using outcome measures. Intervention was given to each group separately for 12 days. Final assessment was taken after the 12 days of physiotherapy treatment using same outcome measures. Comparison of post test values between the groups was done finally.

3.12 TECHNIQUE OF DATA ANALYSIS & INTERPRETATION:

Data collected from subjects were analyzed using ANOVA to measure changes between post test values of the group. Comparisons between groups on outcomes were made using **one – way ANOVA** . **Tukey's HSD** was applied following significant main effects to identify pair wise differences. All these statistical analysis was done using **SPSS 16.0 version** .

Paired ‘t’ test

$$SD = \sqrt{\frac{\sum (d - \overline{d})^2}{n-1}}$$

$$t = \frac{\overline{d}\sqrt{n}}{SD}$$

$\overline{d}$ = Calculated Mean Difference of Pre-test and Post-test values

SD = Standard Deviation

n = Number of samples

d = Difference between Pre-test and Post-test values

ANOVA (ANALYSIS OF VARIANCE)

Source of variation	Sum of square (SS)	Degrees of Freedom (df)	Mean Square (MS)	F
Treatment between the groups	**SSB=** $\sum_{nj\ EMBED} (\bar{x}_j - \bar{\bar{x}})^2$	**k-1**	**MSB= SSB / k-1**	**F= MSB / MSE**
Error or residual within groups	**SSE=** $\sum\sum_{EMBED} (x - \bar{x}_j)^2$	**n-k**	**MSE= SSE / n-k**	
Total	$\sum\sum_{EMBED} (x - \bar{\bar{x}}_j)^2$	**n-1**		

X =individual observation

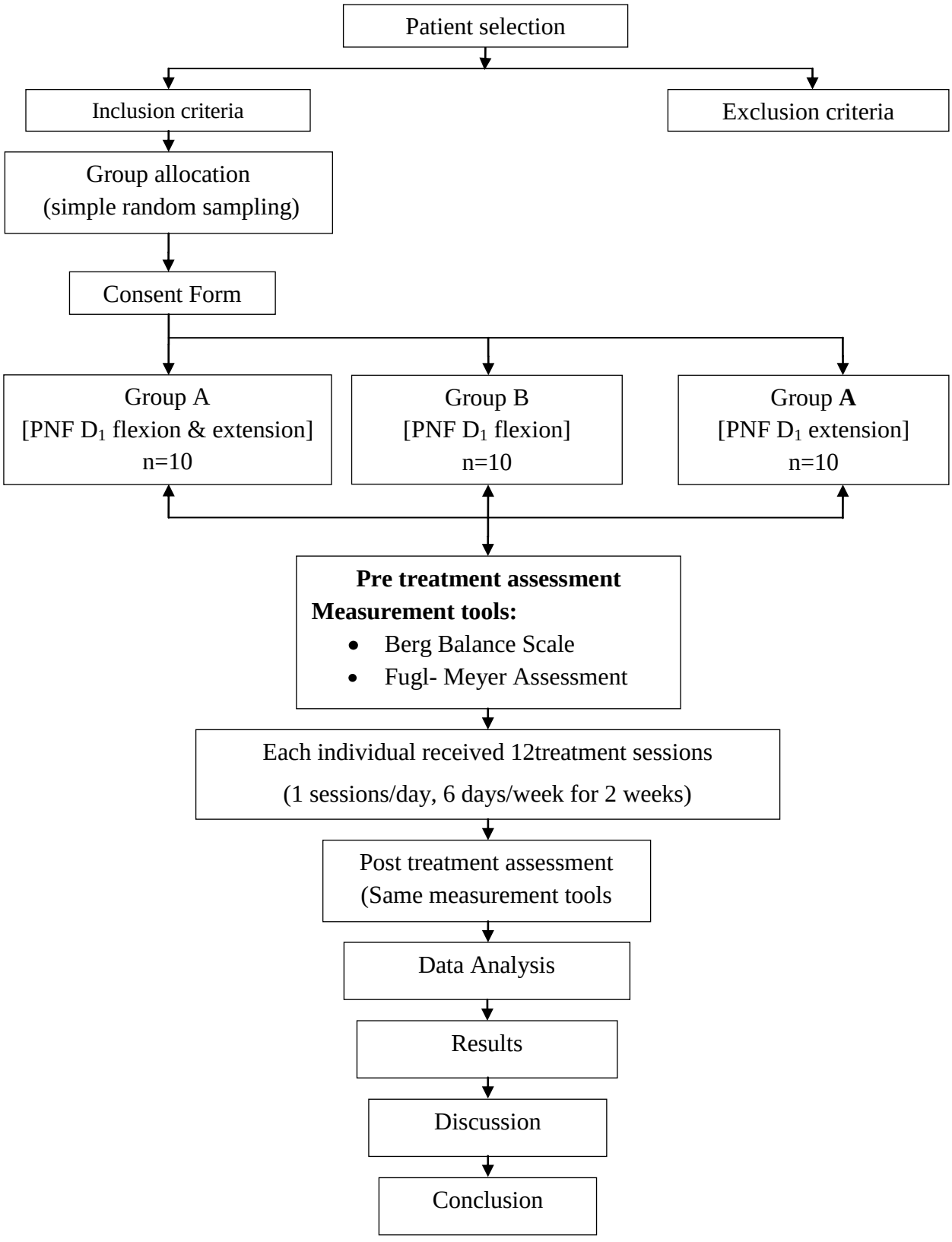
$\bar{X}j$ = sample mean of the j th generation

$\bar{\bar{X}}$ = Overall sample mean

k = the number of treatments or independent comparison groups

n = total number of observations or total sample size

SHEMATIC REPRESENTATION OF FLOW OF PARTICIPANTS



CHAPTER-IV

STATISTICAL ANALYSIS AND INTERPRETATION

A total of 30 patients were selected by simple random sampling method.

The remaining 30 patients were randomly assigned in to 3 groups and received a proprioceptive Neuromuscular facilitation D_1 flexion and extension ,D_1 flexion and D_1 extension irradiation techniques.

The pre test and post test values of Berg Balance Scale, and Fugl Meyer Assessment were taken in all 3 groups.

The Mean, Standard deviation and paired 't' test, one way ANOVA values were used to find out any significant difference between 3 groups.

Data collected from experimental and control group subjects were analyzed using paired 't' test to measure the changes between the pre and post test values within the group and ANOVA to measure the changes within the groups.

All these statistical analysis were performed through **SPSS 16.0 version** (SPSS Statistical Package, 2007, Chicago, IL)

TABLE:1

PRE & POST TEST VALUES OF BERG BALANCE SCALE IN GROUP A (n=10)

S No.	Pre test	Post test
1	1	3
2	2	3
3	1	2
4	1	2
5	1	4
6	1	3
7	1	3
8	1	2
9	1	3
10	1	2

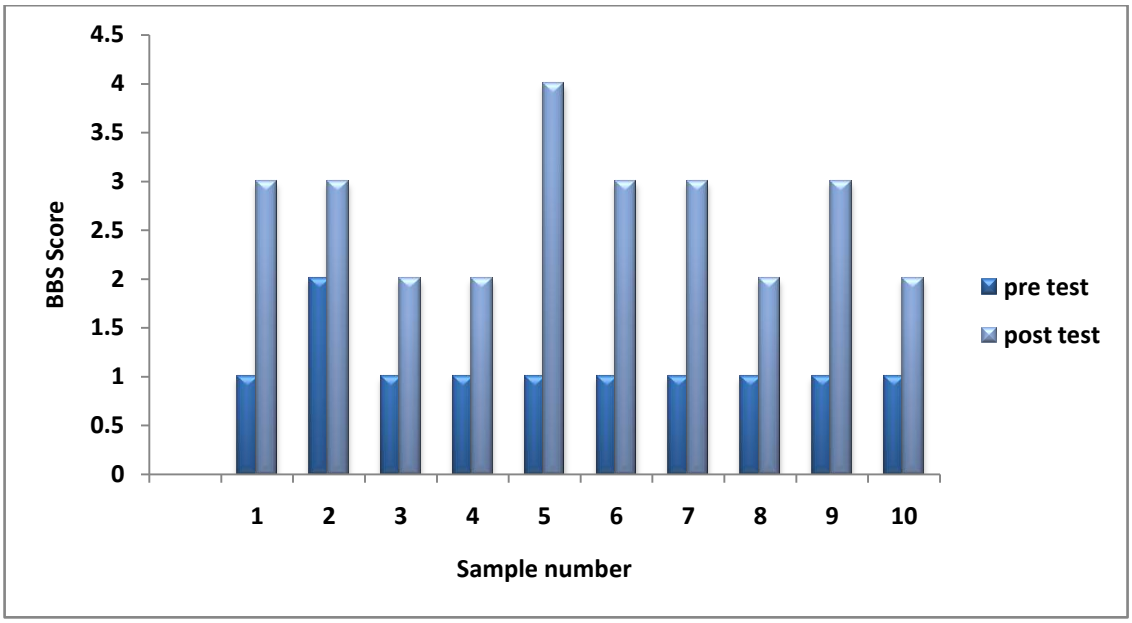
TABLE :2

PRE & POST TEST VALUES OF BERG BALANCE SCALE IN GROUP B (n=10)

S No.	Pre test	Post test
1	1	2
2	1	1
3	1	2
4	1	2
5	2	2
6	1	2
7	1	2
8	1	2
9	1	1
10	1	2

GRAPH 1

PRE & POST TEST VALUES OF BERG BALANCE SCALE IN GROUP A (n=10)



GRAPH 2

PRE & POST TEST VALUES OF BERG BALANCE SCALE IN GROUP B (n=10)

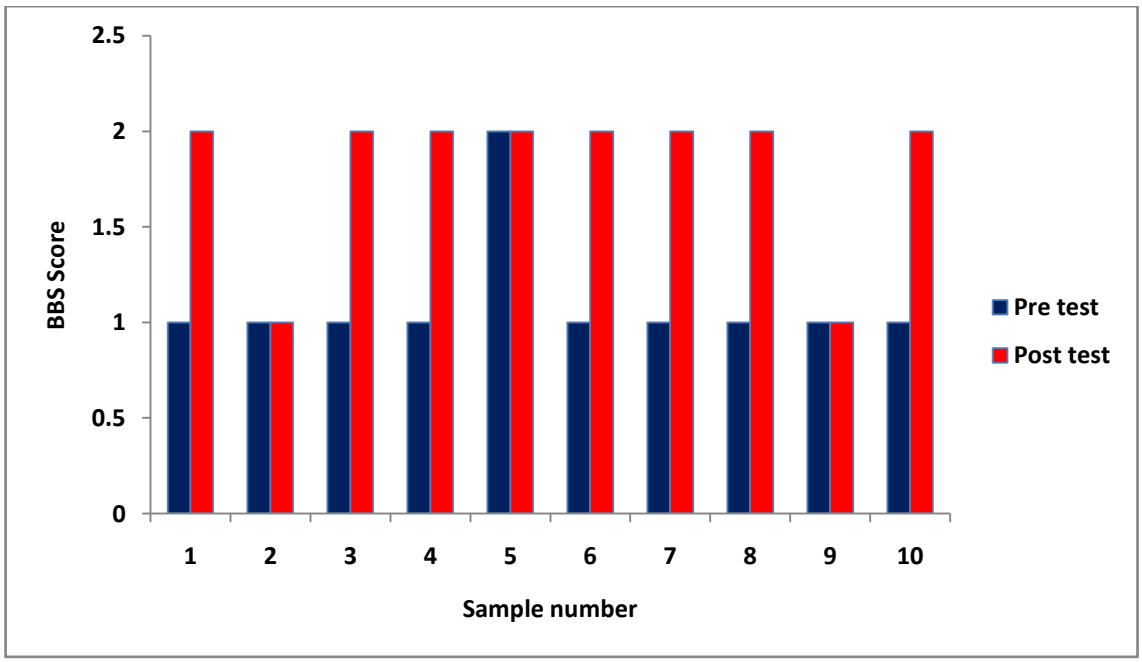


TABLE: 3

PRE & POST TEST VALUES OF BERG BALANCE SCALE IN GROUP C (n=10)

S No.	Pre test	Post test
1	1	1
2	1	3
3	1	2
4	1	2
5	1	2
6	2	2
7	1	1
8	1	2
9	2	2
10	1	2

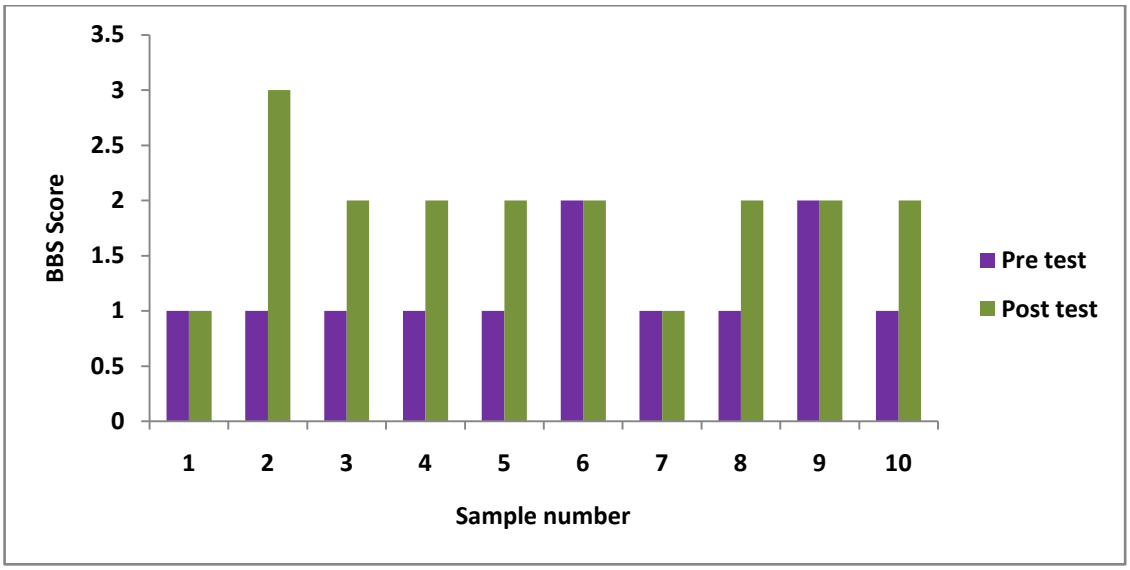
TABLE: 4

PRE & POST TEST VALUES OF FUGL MEYER ASSESSMENT SCALE IN GROUP A (n=10)

S No.	Pre test	Post test
1	4	5
2	2	4
3	2	3
4	2	4
5	2	4
6	2	4
7	2	3
8	3	4
9	2	4
10	2	4

GRAPH 3

PRE & POST TEST VALUES OF BERG BALANCE SCALE IN GROUP C (n=10)



GRAPH 4

PRE & POST TEST VALUES OF FUGL MEYER ASSESSMENT SCALE IN GROUP A (n=10)

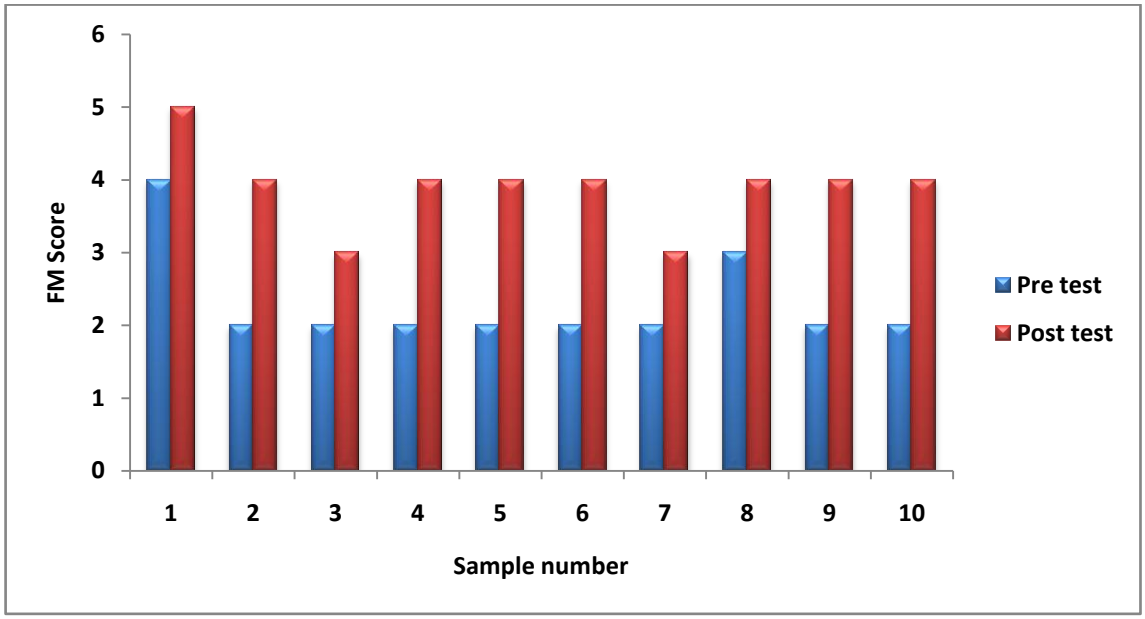


TABLE: 5

PRE & POST TEST VALUES OF FUGL MEYER ASSESSMENT SCALE IN GROUP B (n=10)

S No.	Pre test	Post test
1	4	4
2	2	2
3	2	2
4	2	2
5	2	4
6	2	2
7	2	3
8	2	2
9	2	3
10	2	4

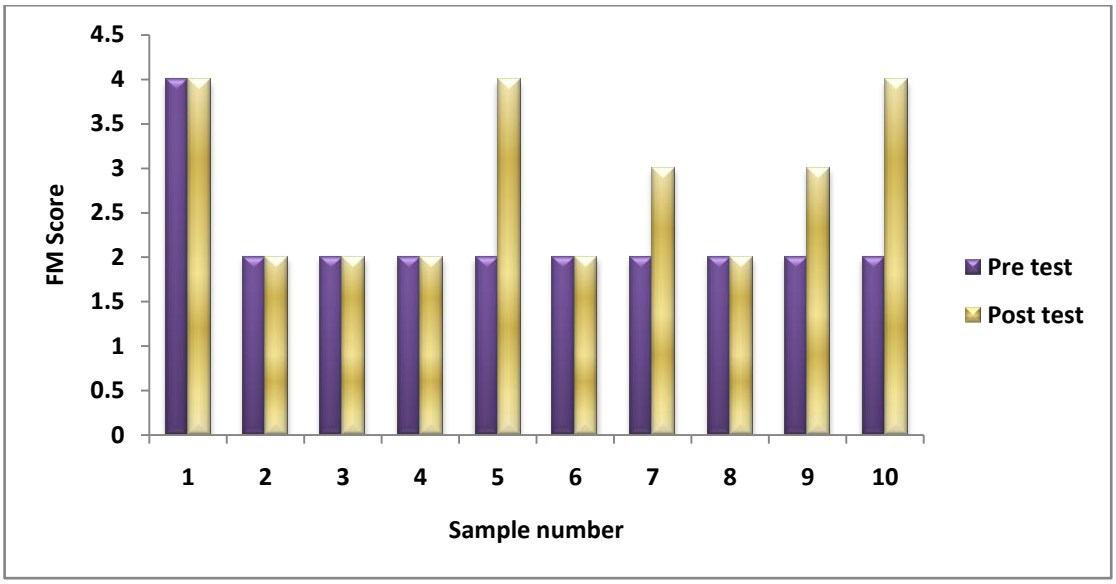
TABLE :6

PRE & POST TEST VALUES OF FUGL MEYER ASSESSMENT SCALE IN GROUP C (n=10)

S No.	Pre test	Post test
1	2	2
2	2	4
3	2	2
4	2	2
5	2	2
6	2	4
7	2	2
8	2	2
9	2	4
10	2	2

GRAPH 5

PRE & POST TEST VALUES OF FUGL MEYER ASSESSMENT SCALE IN GROUP B (n=10)



GRAPH 6

PRE & POST TEST VALUES OF FUGL MEYER ASSESSMENT SCALE IN GROUP C (n=10)

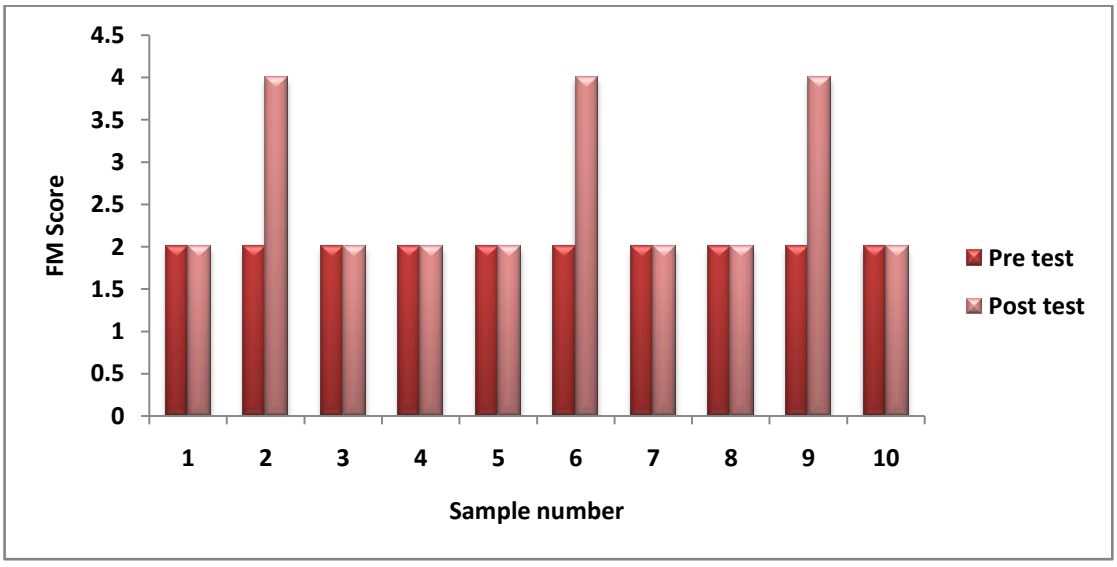


TABLE :7

BERG BALANCE SCALE (BBS): Mean, Mean Difference, Standard Deviation of PNF D_1 Flexion And Extension Pattern(A), D_1 Flexion Pattern(B) And D_1 Extension Pattern(C) Groups

GROUPS	MEAN	MEAN DIFFERENCE	STANDARAD DEVIATION	't' VALUE	'p' VALUE
Group A					
Pre test	1.100	1.600	0.699	7.236	p <0.05
Post test	2.700				
Group B					
Pre test	1.100	0.700	0.483	4.583	p <0.05
Post test	1.800				
Group C					
Pre test	1.200	0.700	0.674	3.280	p <0.05
Post test	1.900				

Table 7 shows mean difference, Standard Deviation, paired 't' value of BBS in Group A, Group B, and Group C.

The mean difference between pre and post intervention for BBS were 1.600, 0.700, 0.700 and obtained paired 't' value were 7.236, 4.583, 3.280 respectively in all 3 groups.

The corresponding 'p' value for BBS in all three groups were $p<0.05$.

Therefore, the result shows that there is a statistical significance difference in post intervention value of BBS compared to pre intervention values of all 3 groups.

TABLE: 8

FUGL MEYER ASSESSMENT (FMA-LE): Mean, Mean Difference, Standard Deviation of PNF D_1 Flexion And Extension Pattern(A), D_1 Flexion Pattern(B) And D_1 Extension Pattern(C) Groups

GROUPS	MEAN	MEAN DIFFERENCE	STANDARAD DEVIATION	't' VALUE	'p' VALUE
Group A					
Pre test	2.300	1.600	.516	9.798	p <0.05
Post test	3.900				
Group B					
Pre test	2.200	.600	.843	2.250	p <0.05
Post test	2.800				
Group C					
Pre test	2.000	.600	.966	1.964	p <0.05
Post test	2.600				

Table 8 shows mean difference, Standard Deviation, paired 't' value of FMA-LE in Group A, Group B, and Group C.

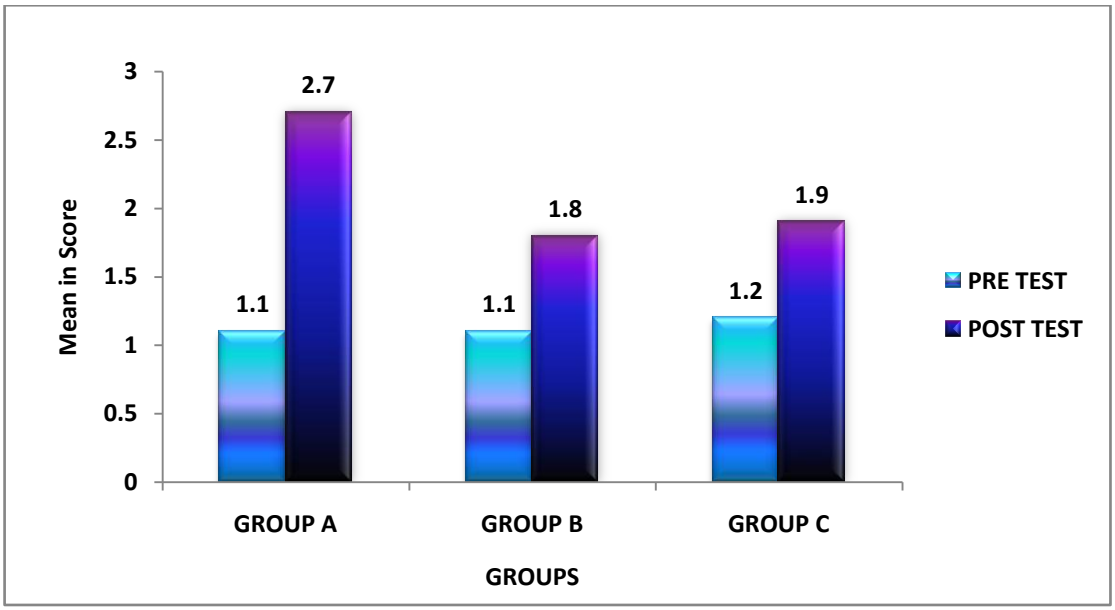
The mean difference between pre and post intervention for FMA-LE were 1.600,0.600,0.600 and obtained paired 't' value were 9.798, 2.250, 1.964 respectively in all 3 groups.

The corresponding 'p' value for FMA-LE in all Groups were $p<0.05$.

Therefore, the result shows that the pre test and post test mean difference of FMA-LE of Group A is statistically significant than Group B & C.

GRAPH 7

PRE & POST TEST MEAN VALUES OF BBS



GRAPH 8

PRE & POST TEST MEAN VALUES OF FMA

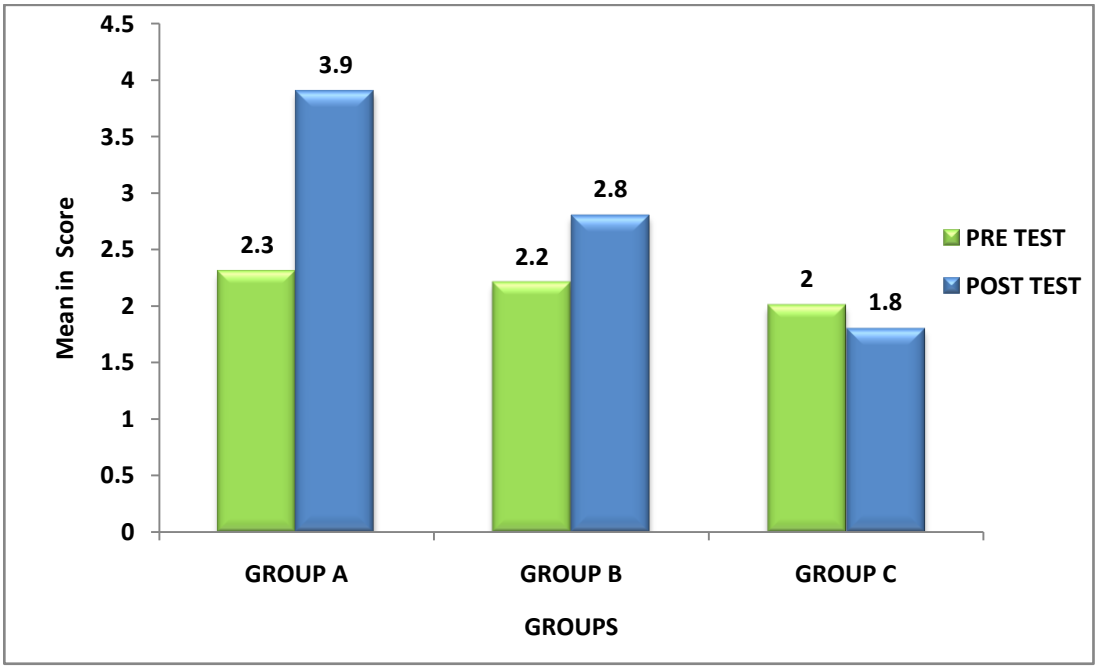


TABLE :9

BERG BALANCE SCALE (BBS)

ONE WAY ANOVA

ANOVA: Sum of Squares, Degrees of Freedom, Mean Square, 'F' And 'P' Values of PNF D_1 Flexion And Extension Pattern(A), D_1 Flexion Pattern(B) And D_1Extension Pattern(C) Groups

	Sum of Squares	Degrees of freedom	Mean Square	F value	P value
Between Groups	4.867	2	2.433	7.640	p<0.05 (.002)
Within Group	8.600	27	.319		
Total	13.467	29			

Table 9 shows Sum of squares, Degrees of freedom, paired 'F' value of BBS in Group A, Group B, and Group C.

In between groups sum of square is 4.867, Mean square is 2.433, within group sum of square is 8.600, Mean square is 0.319 and obtained 'F' value were 7.640 for all 3 groups.

The corresponding 'p' value for BBS in Groups were p<0.05.

TABLE :10

Post Hoc Tests : Multiple Comparison, Mean Difference And 'P' Value of PNF D_1Flexion And Extension Pattern(A), D_1 Flexion Pattern(B) And D_1 Extension Pattern(C) Groups

GROUPS	COMPARE WITH	MEAN DIFFERENCE	'p' VALUE
Group A N=10	Group B	.900	p<0.05
Group B N=10	Group C	.100	p<0.05
Group C N=10	Group A	-.800	p<0.05

Table 10 shows mean difference, 'p' value and post hoc analysis (tukey) of BBS in Group A, Group B, and Group C.

The corresponding 'p' value for BBS in all three groups were p□0.05.

Therefore, the result shows that there is statistical a significance difference in post intervention values of BBS of all 3 groups.

TABLE :11

Means for groups in homogeneous subsets of PNF D_1 Flexion And Extension Pattern(A), D_1 Flexion Pattern(B) And D_1 Extension Pattern (C) Groups

Group	N	'p' value < 0.05
Group A	10	2.70
Group B	10	1.80
Group A	10	1.90

TABLE :12

FUGL MEYER ASSESSMENT (FMA-LE)

ONE WAY ANOVA

ANOVA: Sum of Squares, Degrees of Freedom, Mean Square, 'F' And 'P' Values of PNF D_1 Flexion And Extension Pattern(A), D_1 Flexion Pattern(B) And D_1Extension Pattern (C)Groups

	Sum of Squares	Degrees of freedom	Mean Square	F value	p value
Between Groups	9.800	2	4.900	7.000	P<0.05
Within Groups	18.90	27	.700		
Total	28.70	29			

Table 12 shows Sum of squares, Degrees of freedom, paired 'F' value of FMA-LE in Group A, Group B, and Group C.

In between groups sum of square is 9.800, Mean square is 4.900, within group sum of square is 18.90, Mean square is 0.700 and obtained 'F' value were 7.000 for all 3 groups.

The corresponding 'p' value for FMA-LE in Groups were $p<0.05$.

TABLE :13

Post Hoc Tests : Multiple Comparison, Mean Difference And 'P' Value of PNF D_1 Flexion And Extension Pattern(A), D_1 Flexion Pattern(B) And D_1 Extension Pattern(C) Groups

GROUPS	COMPARE WITH	MEAN DIFFERENCE	'p' VALUE
Group A N=10	Group B	1.100	p<0.05
Group B N=10	Group C	.200	p>0.05
Group C N=10	Group A	1.300	p>0.05

Table 13 shows mean difference, 'p' value and post hoc analysis (Tukey's) of FMA-LE in Group A, Group B, and Group C.

The corresponding 'p' value for FMA-LE in Group A p<0.05. Where, Group B and C were p>0.05.

Therefore, the result shows that there is a statistical significance difference in post intervention values of FMA-LE of Group A, than Group B & C. And **post hoc analysis** in homogenous subsets of FMA-LE shows PNF D_1 flexion and extension second was PNF D_1 flexion and third was PNF D_1 extension after post intervention

GRAPH 9

POST HOC Analysis of BBS &FMA;LE

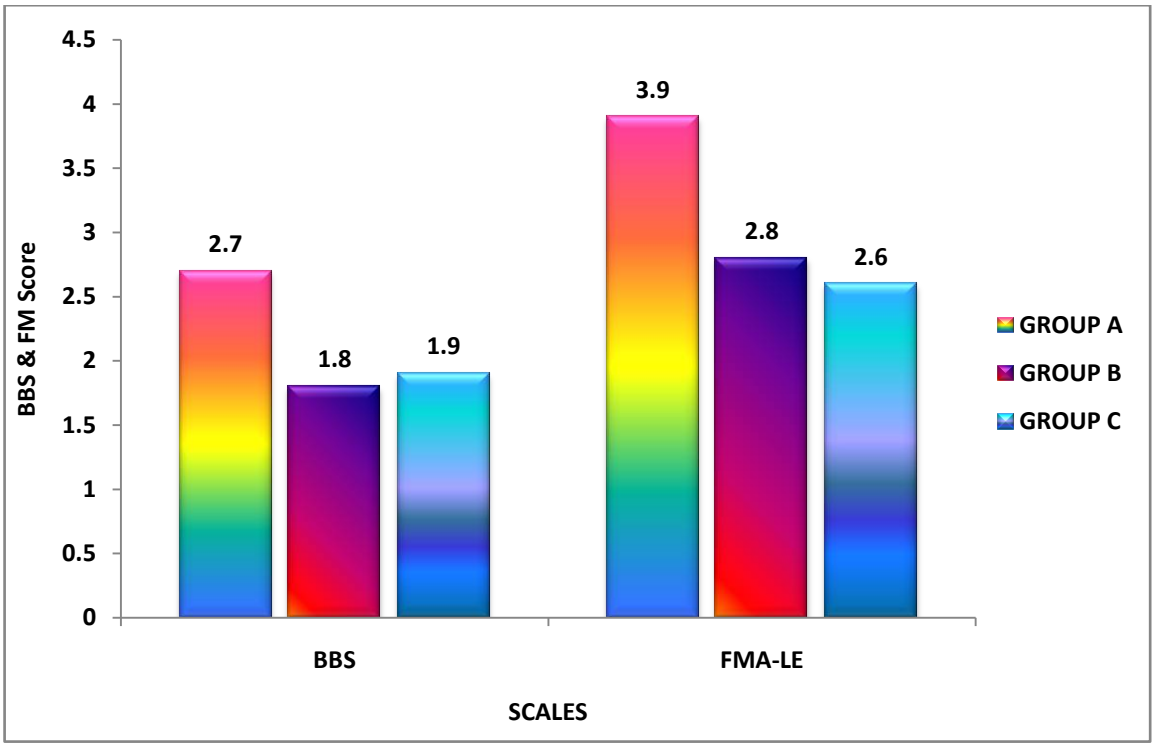


TABLE :14

Means for groups in homogeneous subsets of PNF D_1 Flexion And Extension Pattern(A), D_1 Flexion Pattern(B) And D_1 Extension Pattern(C) Groups.

Group	N	'p' value < 0.05
Group A	10	3.90
Group B	10	2.80
Group A	10	2.60

CHAPTER-V

RESULTS AND DISCUSSION

Mean value of BBS is increased in Group A from 1.100 to 2.700, Group B is 1.100 to 1.800, and Group C is 1.200 to 1.900. It shows statistically significant ($p<0.05$) difference between pre and post intervention among all three groups.

According to the calculated one way ANOVA shows statistically a significant difference between three groups ($F= 7.640$ $p<0.05$) in BBS. And **post hoc analysis** in homogenous subsets of BBS shows there was a significant difference among all three groups.

The above result states that there is an improvement in Balance, after the application of PNF D_1 flexion and extension, PNF D_1 flexion and PNF D_1 extension irradiation on contralateral side .

Mean value of FMA-LE is increased in Group A from 2.300 to 3.900,Group B is 2.200 to 2.800, and Group C is 2.000 to 2.600. It shows statistically significant ($p<0.05$) difference between pre and post intervention among all three groups.

According to the calculated ANOVA there is a statistical significant difference between three groups ($F=7.000$ $p<0.05$) in FMA-LE. And **post hoc analysis** in homogenous subsets shows the efficacy of Group A is better than the Group B&C on analyzing through FMA-LE was noticed in this study.

The following discussion intend to explain the observations made and the results obtained through this study in the light of available scientific evidence.

A total of 30 participants including 18 male and 12 female subjects successfully completed all techniques and tests involved in the study.

The result of my study shows: The PNF D_1 flexion and extension was effective than PNF D_1 flexion and PNF D_1 extension irradiation on contralateral side improving balance and muscle activity.

Discussion of results within group: Effective irradiation by contralateral PNF pattern:

Within group comparison of pre-test and post-test readings for all three groups have shown significant ($p<0.05$) increase balance in the body, when PNF patterns were performed both isometrically and isotonically. This finding shows effective irradiation by contralateral lower PNF patterns to opposite lower limb improve balance in the stroke patients.

The possible factors responsible for cross-training or irradiation can be explained by the following hypothesis: "callosal access" hypothesis suggests that, motor engrams developed in the one hemisphere can be accessed by the opposite hemisphere via the corpus callosum to facilitate task performance with the untrained limb.

Hellebrandt et al., also stated that whenever unilateral exercise of large muscle groups is performed against heavy resistance, wide spread postural readjustment always occur and these call forth the synergistic co-contraction of many muscle groups involving the trunk and remote extremity as well as those of the opposite limb.

It has been accepted that cross-education occurs from homologous to homologous muscle. This could be possible reason for effectiveness of lower limb PNF pattern.

Irradiation by contralateral lower limb PNF D_1flexion and extension patterns was better than contralateral lower limb PNF D_1 flexion and PNF D_1extension patterns:

On comparison between three combine groups of lower limb, results shows that who were given isotonic and isometric pattern deferred significant difference between PNF lower limb patterns. The mean of lower limb PNF D_1 flexion and extension pattern was higher than the mean of contralateral lower limb PNF D_1 flexion and PNF D_1

extension pattern, so these data reveals that contralateral lower limb PNF D_1 flexion and extension pattern causes greater improvement of balance and strength.

Many researches support this finding and according to them cross education occurs homologous muscle to homologous muscle, i.e., homologous limb to homologous limb.

During D_1 flexion PNF pattern (flexion- adduction - external rotation), of lower limb muscles activated at ipsilateral side at hip were psoas major, iliacus, adductor muscles, sartorius, pectineus, rectus femoris, at knee were hamstrings, gracilis, gastrocnemius, and at ankle was tibialis anterior.

According to above stated research findings, the agonists and antagonists i.e. flexor and extensor muscles should also be activated around the contralateral homologous joint during ipsilateral training. This similar effect was seen in our study, the extension muscle force of the contralateral limb was increased after ipsilateral limb was given flexion pattern.

During D_1 extension PNF pattern (extension-abduction-internal rotation) of lower limb, muscles activated at hip were gluteus medius, gluteus maximus (upper), and hamstrings, at knee are quadriceps, at ankle are gastrocnemius, soleus, peroneus longus and brevis. According the above mechanism **("cross activation" hypothesis)** and other researches, in contralateral limb also the opposite and homologous muscle should be activated during ipsilateral training. This similar effect was seen in our study, the extension muscle force of the contralateral limb was increased after ipsilateral limb was given extension pattern.

Discussion of results between groups: Effective irradiation by contralateral PNF pattern:

On comparison between three combine groups , there was a significant ($p < 0.05$) difference at baseline, even at post intervention there was a significant ($p < 0.05$) difference in contralateral lower limb PNF D_1 flexion and extension pattern than contralateral lower limb PNF D_1 flexion and PNF D_1 extension patterns .

From biomechanical point of view, tension in a muscle varies with the type of contraction. Isometric contraction produces greater tension than do concentric contractions .For simple movements, the magnitude of the crossed cortical effects is related to the force of contraction. Thus, during isometric contraction the irradiation should be more, but this finding is not in agreement with our results. During isotonic training 3 sets of 10 repetitions of PNF pattern were performed but during isometric training only 3 repetitions of PNF pattern were performed. The effectiveness of a resistance training program is dependent upon several factors including frequency, volume of training (sets × repetition × resistance) and mode of training[1].

In lower limb, irradiation by PNF D_1 flexion and extension(A) pattern was better than PNF D_1 flexion (B) and PNF D_1 extension(C) pattern:

Between the group comparison shows significant ($p<0.05$) difference among them and within group comparison shows that the mean of group A was higher than group B & C. This signifies that, more improvement was seen in group A comparatively to group B& C. Thus we can infer from the results that irradiation by PNF D_1 flexion and extension(A) pattern was better than PNF D_1 flexion (B) and PNF D_1 extension(C) pattern.

5.1 LIMITATIONS OF THE STUDY:

- This study included only a small number of participants.
- There was a lack of long term follow up of patients to find out the carry over effects of the intervention.
- Inclusion of this study is done only among MCA tertiary stroke.

5.2 SUGGESTION FOR FUTURE RESEARCH:

- Large sample size can be used to demonstrate the effect of intervention.
- Outcome measures such as dynamometry, electromyography and strain gauge can be used.

CHAPTER-VI

SUMMARY AND CONCLUSION

With reference to the statistical analysis and interpretation done for data collected by BBS , it was concluded that PNF D_1 flexion and extension irradiation(Group A) was more effective than PNF D_1 flexion (Group B) and PNF D_1 extension (Group C) irradiation on contralateral side in hemiplegic stroke patients.

Therefore from the literature review available and the statistical analysis of the data obtained my study showed that;

"The PNF D_1 flexion and extension was effective than PNF D_1 flexion and PNF D_1 extension irradiation on contralateral side improving balance and muscle activity'.

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ANNEXURE – I

PSG Institute of Medical Sciences & Research
Institutional Human Ethics Committee
Recognized by The Strategic Initiative for Developing Capacity in Ethical Review (SIDCER)
POST BOX NO. 1674, PEELAMEDU, COIMBATORE 641 004, TAMIL NADU, INDIA
Phone : 91 422 - 2598822, 2570170, Fax : 91 422 - 2594400, Email : ihec@psgimsr.ac.in

To
Ms Keerthanadevi V
I Year MPT
Guides: Mr R Mahesh / Mrs P Sweety Subha
PSG College of Physiotherapy
Coimbatore

Ref: Project No.17/149

Date: July 21, 2017

Dear Ms Keerthanadevi,

Institutional Human Ethics Committee, PSG IMS&R reviewed and discussed your application dated 24.04.2017 to conduct the research study entitled "*Effect of lower limb irradiation by proprioceptive neuromuscular facilitation on balance in stroke patients*" during the IHEC meeting held on 19.05.2017.

The following documents were reviewed and approved:

1. Project submission form
2. Study protocol (Version 1 dated 24.04.2017)
3. Informed consent forms (Version 2 dated 12.07.2017)
4. Data Collection Tool (Version 2 dated 12.07.2017)
5. Permission letter from concerned Heads of Department
6. Current CVs of Principal investigator, Co-investigator
7. Budget

The following members of the Institutional Human Ethics Committee (IHEC) were present at the meeting held on 19.05.2017 at IHEC Secretariat, PSG IMS & R between 10.00 am and 11.00 am:

Sl. No.	Name of the Member of IHEC	Qualification	Area of Expertise	Gender	Affiliation to the Institution Yes/No	Present at the meeting Yes/No
1	Mr R Nandakumar (Chairperson, IHEC)	BA , BL	Legal Expert	Male	No	Yes
2	Dr S Bhuvaneshwari (Member-Secretary, IHEC)	MD	Clinical Pharmacology	Female	Yes	Yes
3	Dr S Shanthakumari	MD	Pathology, Ethicist	Female	Yes	Yes
4	Dr Sudha Ramalingam	MD	Epidemiologist, Ethicist Alt. member-Secretary	Female	Yes	Yes
5	Dr D Vijaya	M Sc , Ph D	Basic Medical Sciences (Biochemistry)	Female	Yes	Yes

The study is approved in its presented form. The decision was arrived at through consensus. Neither PI nor any of proposed study team members were present during the decision making of the IHEC. The IHEC functions in accordance with the ICH-GCP/ICMR/Schedule Y guidelines. The approval is valid until one year from the date of sanction. You may make a written request for renewal / extension of the validity, along with the submission of status report as decided by the IHEC.

PSG Institute of Medical Sciences & Research
Institutional Human Ethics Committee

Recognized by The Strategic Initiative for Developing Capacity in Ethical Review (SIDCER)
POST BOX NO. 1674, PEELAMEDU, COIMBATORE 641 004, TAMIL NADU, INDIA
Phone : 91 422 - 2598822, 2570170, Fax : 91 422 - 2594400, Email : ihec@psgimsr.ac.in

Following points must be noted:

1. IHEC should be informed of the date of initiation of the study
2. Status report of the study should be submitted to the IHEC every 12 months
3. PI and other investigators should co-operate fully with IHEC, who will monitor the trial from time to time
4. At the time of PI's retirement/intention to leave the institute, study responsibility should be transferred to a colleague after obtaining clearance from HOD, Status report, including accounts details should be submitted to IHEC and extramural sponsors
5. In case of any new information or any SAE, which could affect any study, must be informed to IHEC and sponsors. The PI should report SAEs occurred for IHEC approved studies within 7 days of the occurrence of the SAE. If the SAE is 'Death', the IHEC Secretariat will receive the SAE reporting form within 24 hours of the occurrence
6. In the event of any protocol amendments, IHEC must be informed and the amendments should be highlighted in clear terms as follows:
   a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
   b. Alteration in the budgetary status should be clearly indicated and the revised budget form should be submitted
   c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval
   d. If the amendment demands a re-look at the toxicity or side effects to patients, the same should be documented
   e. If there are any amendments in the trial design, these must be incorporated in the protocol, and other study documents. These revised documents should be submitted for approval of the IHEC and only then can they be implemented
   f. Any deviation-Violation/waiver in the protocol must be informed to the IHEC within the stipulated period for review
7. Final report along with summary of findings and presentations/publications if any on closure of the study should be submitted to IHEC

Kindly note this approval is subject to ratification in the forthcoming full board review meeting of the IHEC.

Thanking You,

Yours Sincerely,

SECRETARY
PSG IMS&R
COIMBATORE-641004

Dr S Bhuvaneshwari
Member - Secretary
Institutional Human Ethics Committee

ANNEXURE – II

NEUROLOGICAL PHYSIOTHERAPY EVALUATION FORM

I. SUBJECTIVEASSESSMENT

Name: Age: Gender:M/F IP/OP

Occupation: Handedness:R/L Referredby:

Address: Group: A/B/C Sample No:

Chief Complaints:

Associated complaints:

Past Medical History:

Present medical history:

Personal History:

Family History:

Socioeconomic History:

Symptoms History:

Onset: Site:

Duration: Type:

Side: Severity:

Aggravating Factors:

Relieving Factors:

Vital Signs:

Temperature:		Heart Rate:	
Blood Pressure:		Respiratory Rate:	

II. OBJECTIVEEXAMINATION

a) ON OBSERVATION:

- Attitude of limbs:
- Built:
- Posture:
- Gait:
- Pattern of Movement:
- Oedema:
- Muscle Wasting:
- Pressure Sores:
- Deformity:
- External Appliances:

b) ON PALPATION

- Warmth:
- Tenderness:

Tone:

Upperlimb		
Lowerlimb		

- Swelling:

C.ON EXAMINATION

HIGHER MENTAL FUNCTIONS

- Level of Consciousness:
- Orientation:
    - Person:
    - Place:
    - Time
- Memory:
    - Immediate:
    - Recent:
    - Remote:
    - Verbal:
    - Visual:
- Communication:
- Cognition:
    - Fund of Knowledge:
    - Calculation:
    - Proverb Interpretation:
- Attention:
- Emotional Status:
- Perception:
    - BodyScheme/BodyImagin:
    - Agnosias/ Apraxias:
- Special Senses:
- MMSE Score:

CRANIAL NERVES:

Nerves	Comments	Nerves	Comments
I – Olfactory		VII - Facial	
II – Optic		VIII - VestibuloCochlear	
III – Oculomotor		IX - Glossopharyngeal	
IV – Trochlear		X – Vagus	
V – Trigeminal		XI - Accessory	
VI – Abducent		XII - Hypoglossal	

SENSORY SYSTEM:

Location	Upper Extremity		Lower Extremity		Trunk		Comments
Sensation	Rt.	Lt	Rt.	Lt.	Rt.	Lt.	
Superficial							
Pain							
Temperature							
Touch							
Pressure							
Deep							
Mov. Sense							
Pos. Sense							
Vibration							
Cortical							
Tactile Localization							
2 pt. discrimination							
Stereognosis							
Barognosis							
Graphesthesia							
Texture Recognition							
Double Simultaneous Stimulation							

MOTOR SYSTEM:

- Muscle Girth:

Area	Rt.(cm.)	Lt.(cm.)
Arm		
Forearm		
Thigh		
Calf		

- Voluntary Control:

Side	Rt.	Lt.
Upper Limb		
Lower Limb		

- Limb Length

Side	Rt.(cm.)	Lt.(cm.)
True		
Apparent		

Muscle Tone:

Muscles	Rt.	Lt.
Shoulder		
Flexors		
Extensors		
Abductors		
Adductors		
External Rotators		
Internal Rotators		
Elbow		
Flexors		
Extensors		
Forearm		
Pronators		
Supinators		
Wrist		
Flexors		
Extensors		
Radial Deviators		
Ulnar Deviators		
Hand		
Intrinsics		
Extrinsics		

Muscles	Rt.	Lt.
Hip		
Flexors		
Extensors		
Abductors		
Adductors		
External Rotators		
Internal Rotators		
Knee		
Flexors		
Extensors		
Ankle		
Dorsiflexors		
Plantarflexors		
Foot		
Invertors		
Evertors		
Intrinsics		
Extrinsics		

- Muscle Power:

Muscles	Rt.	Lt.
Shoulder		
Flexors		
Extensors		
Abductors		
Adductors		
External Rotators		
Internal Rotators		
Elbow		
Flexors		
Extensors		
Forearm		
Pronators		
Supinators		
Wrist		
Flexors		
Extensors		
Radial Deviators		
Ulnar Deviators		
Hand		
Intrinsics		
Extrinsics		

Muscles	Rt.	Lt.
Hip		
Flexors		
Extensors		
Abductors		
Adductors		
External Rotators		
Internal Rotators		
Knee		
Flexors		
Extensors		
Ankle		
Dorsiflexors		
Plantarflexors		
Foot		
Invertors		
Evertors		
Intrinsics		
Extrinsics		

Trunk Flexors		
Trunk Extensors		
Trunk Side Flexors		
Trunk Rotators		

- Reflexes:

	Reflex	Left	Right
Superficial	Abdominal		
	Plantar		
Deep	Biceps		
	Brachioradialis		
	Triceps		
	Knee		
	Ankle		

- Pathological:

- Fugl Meyer Score:

- Coordination:

Non Equilibrium Tests	Rt.	Lt.
Finger to nose		
Finger opposition		
Mass Grasp		
Pronation/Supination		
Rebound test		
Tapping (Hand)		
Tapping (Foot)		
Heel to knee		
Drawing a circle(Hand)		
Drawing a circle(Foot)		

Equilibrium tests	Grade
Standing: Normal Posture	
Standing: Normal Posture with vision occluded	
Standing: Feet together	
Standing on one foot	
Standing: Lateral trunk flexion	
Tandem walking	
Walk: Sideways	
Walk: Backward	
Walk in a circle	
Walk on heels	
Walk on toes	

- Involuntary Movements:

- Balance:
  - Sitting:
  - Standing:
  - Balance Reactions:
  - BBS Score:
- Posture:
  - Lying:
  - Sitting:
  - Standing:
- Gait
  - Step Length:
  - Stride Length:
  - Base width:
  - Cadence:
  - Biomechanical Deviations:
- Hand Functions:
  - Reaching:
  - Grasping:
  - Releasing:

- Assistive Device:

Problem List:

Sl.	Impairment	Functional Limitation

Functional diagnosis:

Management

Goals:

Short term

Long term:

Treatment:

ANNEXURE – III

PROFORMA

Patient Name :

Age :

Sex :

Occupation :

Address :

IP/ OP No :

Contact no :

Date of Assessment:

Diagnosis :

Post Stroke Duration:

OUTCOME MEASUREMENTS SCORING:

S.NO	OUTCOME MEASURES	Pretest	Posttest
1	Berg Balance Scale		
2	Fugl Meyer Assessment Lower Extremity		

Chief complaints:

Date:

Place: Therapist Signature

ANNEXURE –IV

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH STUDY

PATIENT INFORMATION FORM

I Keerthanadevi.V, am carrying out a study on: **"EFFECT OF LOWER LIMB IRRADIATION BY PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON BALANCE IN STROKE PATIENTS"**,as part of my research project being carried out under the aegis of the Department of Neurology & Department of Physical Medicine Rehabilitation.

My research guide is:Prof. R.Mahesh, MPT(Cardio Respiratory)
Co-guide is:Mrs. SweetySubha. P, MPT (Neurology)

The justification for this study is:

- Stroke is a leading cause of impaired balance and functional activities. There are many techniques for improving balance in stroke. PNF is widely used in stroke population and there are many studies suggesting the use of PNF in stroke for improving balance and functional activities.Until recently there has been limited evidence to support the use of PNF irradiation techniques on balance and functional activities.

The objectives of this study are:

- To find out the effectiveness of PNF training on contralateral lower extremity on balance in stroke patients.

Sample size: 30.

Study volunteers / participants: acute hemiplegic stroke patients, age group of 40-65yrs.

Location: Department of Neurology &Department of PMR, PSG IMS&R Hospitals..

We request you to kindly cooperate with us in this study. We propose collect background information and other relevant details related to this study. We will be carrying out:

Initial interview :20 minutes.

Data collected will be stored for a period of 5 years. We will not use the data as part of another study.

Health education sessions: 45minutes per session, 6 sessions per week for 2 weeks.

Final interview :15 minutes.

If **photograph** is taken: **YES**, without revealing the identity of yours we want to publish in project book, conferences and journals.

Benefits from this study: Performing PNF irradiation training can improves overall balance.

Risks involved by participating in this study: There are no possible risks or discomforts will be experienced during this study.
Clinical examination :**YES**

Blood sample collection: Specify quantity of blood being drawn: _____ml. **NA**

No. of times it will be collected: _____. **NA**

Whether blood sample collection is part of routine procedure or for research (study) purpose:
1. Routine procedure 2. Research purpose

Specify **purpose**, discomfort likely to be felt and side effects, if any: **NA**
Whether blood sample collected will be stored after study period: **NA**

Whether blood sample collected will be sold: **NA**

Whether blood sample collected will be shared with persons from another institution:**NA**

Medication given, if any, duration, side effects, purpose, benefits: **NA**

Whether medication given is part of routine procedure:**NA**

Whether alternatives are available for medication given: **NA**
How the **results** will be used: The data collected during the study will be used without revealing your identity. Your identity will be confidential even if the results of the study are published.

If you are uncomfortable in answering any of our questions during the course of the interview / biological sample collection, **you have the right to withdraw from the interview / study at anytime.** You have the freedom to withdraw from the study at any point of time. Kindly be assured that your refusal to participate or withdrawal at any stage, if you so decide, will not result in any form of compromise or discrimination in the services offered nor would it attract any penalty. You will continue to have access to the regular services offered to a patient. You will **NOT** be paid any remuneration for the time you spend with us for this interview / study. The information provided by you will be kept in strict confidence. Under no circumstances shall we reveal the identity of the respondent or their families to anyone. The information that we collect shall be used for approved research purposes only. You will be informed about any significant new findings- including adverse events, if any, – whether directly related to you or to other participants of this study, developed during the course of this research which may relate to your willingness to continue participation.
Consent: The above information regarding the study, has been read by me/ read to me, and has been explained to me by the investigator/s. Having understood the same, I hereby give my consent to them to interview me. I am affixing my signature / left thumb impression to indicate my consent and willingness to participate in this study (i.e., willingly abide by the project requirements).

Signature / Left thumb impression of the Study Volunteer / Legal Representative:

Signature of the Interviewer with date:

Contact number of PI: 9789584644

Contact number of Ethics Committee Office: During Office hours: 0422 4345818

பூ. சா. கோ மருத்துவக் கல்லூரி மற்றும் ஆராய்ச்சி நிறுவனம், கோவை

மனித நெறிமுறைக் குழு

ஒப்புதல் படிவம்

கீர்த்தனாதேவி .வே, ஆகிய நான் பூ. சா. கோ மருத்துவக் கல்லூரியின் நரம்பியல் துறையின் கீழ், **"அசையுணர்வு நரம்புத்தசைத் தூண்டுதலால்** (Proprioceptive Neuro Muscular Facilitation) **கால்பகுதியில் ஏற்படும் நரம்பு உந்து விசைப் பரவலைப்** (Irradiation) **பயன்படுத்தி பக்கவாத நோயாளிகளின் உடல் சமநிலையில்** (Balance) **ஏற்படும் மாற்றங்களைக் கண்டறிதல்"** என்ற தலைப்பில் ஆய்வு மேற்கொள்ள உள்ளேன்.

என் ஆய்வு வழிகாட்டி: திரு. ரா. மகேஷ், முதல்வர், பூ.சா.கோ பிஸியோதெரபி கல்லூரி, கோவை

திருமதி. ஸ்வீட்டி சுபா .ப, துணைப் பேராசிரியை

ஆய்வு மேற்கொள்வதற்கான அடிப்படை:

பக்கவாத நோயானது உடலின் சம்நிலை மற்றும் உறுப்பியக்க நடவடிக்கைகளைத் தீவிரமாக பலவீனமடைய செய்கிறது. பக்கவாத நோயாளியின் உடலின் சமநிலையை மேம்படுத்த அநேக இயல் நட்புக்கூறு முறைகளுள்ளன. பக்கவாத நோயாளிகளுக்கு அசையுணர்வு நரம்பு தசைத்தூண்டுதல் பரவலாக பயன்படுத்தப்படும் முறையாகும் மற்றும் அசையுணர்வு நரம்புத்தசைத் தூண்டுதல் பக்கவாத நோயாளிகளின் சமநிலை மற்றும் உறுப்பியக்க நடவடிக்கைகளை மேம்படுத்தும் என பல ஆய்வுகள் பரிந்துரைக்கின்றன. அண்மை காலங்களில் ஒரு சில ஆய்வுகள் அசையுணர்வு நரம்புத்தசைத் தூண்டுதல் மறுபக்க கால் பகுதியில் கொடுப்பதால் உடலின் சமநிலை மற்றும் உறுப்பியக்க நடவடிக்கைகளை மேம்படுத்தும் என கூறுகின்றன.

ஆய்வின் நோக்கம்:

பக்கவாத நோயாளிகளில் அசையுணர்வு நரம்புத்தசைத் தூண்டுதல் திறனை மறுபக்க காலுறுப்புக்கு அளிப்பதன் மூலம் ஏற்படும் உடல் சமநிலையில் ஏற்படும் மாற்றங்களைக் கண்டறிதல்.

ஆய்வில் பங்கு பெறும் நபர்களின் எண்ணிக்கை: 30

ஆய்வில் பங்கு பெறுவோர் மற்றும் வயது: 40 - 65 வயதுக்குட்ப்பட்ட, பக்கவாத நோயாளிகள்.

ஆய்வு மேற்கொள்ளும் இடம்: நரம்பியல் மற்றும் புனர்வாழ்வு மருத்துவ துறைகள், பூ.சா.கோ. மருத்துவமனை, கோயம்புத்தூர்.

இந்த ஆய்வில் எங்களுடன் ஒத்துழைக்குமாறு கேட்டுக்கொள்கிறோம். நாங்கள் சில தகவல்களை இந்த ஆய்விற்காக சேகரிக்க உள்ளோம்.

ஆய்வு செய்யப்படும் முறை:

முதல் கட்ட ஆய்வின் போது தங்களுடலின் சமநிலையைக் கண்டறிய பெர்க் பேலன்ஸ் (Berg Balance Scale) மற்றும் காலுறுப்புக்கான ஃப்யூகல் மேயர் (Fugl Mayer-Lower limb) அளவிகளின் மூலம் அளவிடப்படும். பின்னர் அசையுணர்வு நரம்புத்தசை தூண்டுதல் சிகிச்சை மூலம் உடலில் சமநிலையில் மற்றும் உறுப்பியக்க நடவடிக்கைகளில் ஏற்படும் மாற்றங்களை கண்டறிய தினமும் ஒருமுறை வீதம் (ஒரு அமர்வு 45 நிமிடங்கள்) வாரம் 6 முறை இரண்டு வாரங்களுக்கு சிகிச்சை அளிக்கப்படும். சிகிச்சைகள் முடிந்தப்பின் தங்கள் உடலின் சமநிலை மற்றும் உறுப்பியக்க நடவடிக்கைகளை மீண்டும் மதிப்பிட்டு முடிவுகளை ஆரம்ப மதிப்பீட்டுடன் ஒப்பிடப்படும்.

முதன்மை நேர்காணல்: 20 நிமிடங்கள்

இறுதி நேர்காணல்: 15 நிமிடங்கள்

இந்த ஆய்வில் கிடைக்கும் தகவல்கள் **5 வருடங்கள்** பாதுகாக்கப்படும். இந்த தகவல்கள் வேறு ஆய்விற்குப் பயன்படுத்தப் பட மாட்டாது.

சுகாதாரக் கல்வி: அமர்வுகள்: ___ முறை ஒரு அமர்வுக்கான நேரம்: ___ நிமிடங்கள் **பொருந்தாது**

மருத்துவ பரிசோதனைகள்: உண்டு

இரத்த மாதிரி சேகரிப்பு: _____ மிலி _____ முறை **பொருந்தாது**

இரத்த மாதிரி எடுப்பது வழக்கமான சிகிச்சைக்காகவோ அல்லது இந்த ஆய்விற்காகவோ:

பொருந்தாது

இதனால் ஏற்படக் கூடிய அசௌகரியங்கள் / பக்க விளைவுகள்: இதனால் எந்த அசௌகரியமோ, பக்க விளைவுகளோ ஏற்படாது. **பொருந்தாது**

இரத்த மாதிரிகள் ஆய்விற்குப் பின் பாதுகாத்து வைக்கப்படுமா? ஆம் / இல்லை, அழிக்கப்படும்: **பொருந்தாது**

சேகரிக்கப்பட்ட இரத்தம் விற்கப்படுமா? ஆம் / இல்லை **பொருந்தாது**

சேகரிக்கப்பட்ட இரத்தம் வேறு நிறுவனத்துடன் பகிர்ந்து கொள்ளப்படுமா? ஆம் / இல்லை: **பொருந்தாது**

மருந்துகள் ஏதேனும் கொடுக்கப்படவிருந்தால் அவை பற்றிய விவரம் (கொடுக்கப்படும் காரணம், காலம், பக்க விளைவுகள், பயன்கள்): **பொருந்தாது**

மருந்துகள் கொடுக்கப்படுவது வழக்கமான சிகிச்சை முறையா?: ஆம் / இல்லை (இல்லை என்றால் கொடுக்கப்படும் காரணம்) **பொருந்தாது**

கொடுக்கப்படும் மருந்துகளுக்கு மாற்று உள்ளதா?: ஆம் / இல்லை (ஆம் என்றால் இந்த குறிப்பிட்ட

மருந்து கொடுக்கப்படும் காரணம்) **பொருந்தாது**

ஆய்வில் பங்குபெறுவதால் ஏற்படும் பலன்கள்:

இவ்வாய்வில் பங்குபெறுவதால் தங்களின் உடல் சமநிலை (Balance) அடைந்து தங்களின் அன்றாட செயல்திறனும் அதிகரிக்கும்.

ஆய்வினால் ஏற்படக் கூடிய அசௌகரியங்கள் / பக்க விளைவுகள்: இதனால் எந்த அசௌகரியமோ, பக்க விளைவுகளோ ஏற்படாது

ஆய்வின் முடிவுகள் எந்த முறையில் பயன்படுத்தப்படும்?

இந்த ஆய்வில் அசைவுணர்வு நரம்புத்தசை தூண்டுதல் சிகிச்சை கொடுப்பதன் மூலம் ஏற்படும் பலன்களின் தகவல்களை தங்களின் அடையாளம் அறியாவண்ணம் தங்களின் புகைப்படத்துடன் பயன்படுத்தப்படும். அதற்குத் தங்களின் அனுமதி கோருகிறேன். ஆய்வின் முடிவுகள் வெளியிடப்பட்டாலும் தங்கள் அடையாளம் இரகசியமாக இருக்கும்.

இந்த ஆய்வின் கேள்விகளுக்கு பதிலளிப்பதில் உங்களுக்கு ஏதேனும் அசௌகரியங்கள் இருந்தால், எந்த நேரத்தில் வேண்டுமானாலும் ஆய்விலிருந்து விலகிக்கொள்ளும் உரிமை உங்களுக்கு உண்டு. ஆய்விலிருந்து விலகிக்கொள்வதால் உங்களுக்கு அளிக்கப்படும் சிகிச்சை முறையில் எந்த வித பாதிப்பும் இருக்காது என்று

உங்களுக்கு உறுதியளிக்கிறோம். மருத்துவ மனையில் நோயாளிகளுக்கு அளிக்கப்படும் சேவைகளை நீங்கள் தொடர்ந்து பெறலாம். இந்த ஆய்வில் பங்கேற்க ஒப்புக்கொள்ளுவதால் வேறு எந்த விதமான கூடுதலான பலனும் உங்களுக்குக் கிடைக்காது. நீங்கள் அளிக்கும் தகவல்கள் இரகசியமாக வைக்கப்படும். ஆய்வில் பங்கேற்பவர்கள் பற்றியோ அவர்கள் குடும்பத்தைப் பற்றியோ எந்தத் தகவலும் எக்காரணம் கொண்டும் வெளியிடப்படாது என்று உறுதியளிக்கிறோம். நீங்கள் அளிக்கும் தகவல்கள் அங்கீகரிக்கப்பட்ட ஆய்விற்கு மட்டுமே பயன்படுத்தப்படும். இந்த ஆய்வு நடைபெறும் காலத்தில் குறிப்பிடத்தகுந்த புதிய கண்டுபிடிப்புகள் அல்லது பக்க விளைவுகள் ஏதும் ஏற்பட்டால் உங்களுக்குத் தெரிவிக்கப்படும். இதனால் ஆய்வில் தொடர்ந்து பங்கு பெறுவது பற்றிய உங்கள் நிலைப்பாட்டை நீங்கள் தெரிவிக்க ஏதுவாகும்.

ஆய்வுக்குட்படுபவரின் ஒப்புதல்: இந்த ஆய்வைப் பற்றிய மேற்கூறிய தகவல்களை நான் படித்து அறிந்து கொண்டேன் / ஆய்வாளர் படிக்கக் கேட்டுத் தெரிந்து கொண்டேன். ஆய்வினைப் பற்றி நன்றாகப் புரிந்து கொண்டு இந்த ஆய்வில் பங்கு பெற ஒப்புக்கொள்கிறேன். இந்த ஆய்வில் பங்கேற்பதற்கான எனது ஒப்புதலை கீழே கையொப்பமிட்டு. கை ரேகை பதித்து நான் தெரிவித்துக் கொள்கிறேன்.

பங்கேற்பாளரின் பெயர், முகவரி:

பங்கேற்பாளரின் கையொப்பம் / கை ரேகை / சட்டப்பூர்வ பிரதிநிதியின் கையொப்பம்:

தேதி :

ஆய்வாளரின் கையொப்பம்:

தேதி :

ஆய்வாளரின் தொலைபேசி எண்: 9789584644

மனித நெறிமுறைக் குழு அலுவலகத்தின் தொலைபேசி எண்: 0422 2570170

ANNEXURE – V

ASSESSMENT TOOLS

BERG BALANCE SCALE

The Berg Balance Scale (BBS) was developed to measure balance among older people with impairment in balance function by assessing the performance of functional tasks. It is a valid instrument used for evaluation of the effectiveness of interventions and for quantitative descriptions of function in clinical practice and research. The BBS has been evaluated in several reliability studies. *A recent study of the BBS, which was completed in Finland, indicates that a change of eight (8) BBS points is required to reveal a genuine change in function between two assessments among older people who are dependent in ADL and living in residential care facilities.*

Description:
14-item scale designed to measure balance of the older adult in a clinical setting.

Equipment needed: Ruler, two standard chairs (one with arm rests, one without), footstool or step, stopwatch or wristwatch, 15 ft walkway

Completion:

Time: 15-20 minutes

Scoring: A five-point scale, ranging from 0-4. "0" indicates the lowest level of function and "4" the highest level of function. Total Score = 56

Interpretation:
41-56 = low fall risk
21-40 = medium fall risk
0 –20 = high fall risk

A change of 8 points is required to reveal a genuine change in function between 2 assessments.

Berg Balance Scale

Name: _____ Date: _____

Location: _____ Rater: _____

ITEM DESCRIPTION	SCORE (0-4)
Sitting to standing	_____
Standing unsupported	_____
Sitting unsupported	_____
Standing to sitting	_____
Transfers	_____
Standing with eyes closed	_____
Standing with feet together	_____
Reaching forward with outstretched arm	_____
Retrieving object from floor	_____
Turning to look behind	_____
Turning 360 degrees	_____
Placing alternate foot on stool	_____
Standing with one foot in front	_____
Standing on one foot	_____

Total _____

GENERAL INSTRUCTIONS

Please document each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if:

- the time or distance requirements are not met
- the subject's performance warrants supervision
- the subject touches an external support or receives assistance from the examiner

Subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing is a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5, and 10 inches. Chairs used during testing should be a reasonable height. Either a step or a stool of average step height may be used for item # 12.

Berg Balance Scale

SITTING TO STANDING
INSTRUCTIONS: Please stand up. Try not to use your hand for support.
( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal aid to stand or stabilize
( ) 0 needs moderate or maximal assist to stand

STANDING UNSUPPORTED
INSTRUCTIONS: Please stand for two minutes without holding on.
( ) 4 able to stand safely for 2 minutes
( ) 3 able to stand 2 minutes with supervision
( ) 2 able to stand 30 seconds unsupported
( ) 1 needs several tries to stand 30 seconds unsupported
( ) 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL
INSTRUCTIONS: Please sit with arms folded for 2 minutes.
( ) 4 able to sit safely and securely for 2 minutes
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support 10 seconds

STANDING TO SITTING
INSTRUCTIONS: Please sit down.
( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently but has uncontrolled descent
( ) 0 needs assist to sit

TRANSFERS
INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.
( ) 4 able to transfer safely with minor use of hands
( ) 3 able to transfer safely definite need of hands
( ) 2 able to transfer with verbal cuing and/or supervision
( ) 1 needs one person to assist
( ) 0 needs two people to assist or supervise to be safe

STANDING UNSUPPORTED WITH EYES CLOSED
INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.
( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays safely
( ) 0 needs help to keep from falling

STANDING UNSUPPORTED WITH FEET TOGETHER
INSTRUCTIONS: Place your feet together and stand without holding on.
( ) 4 able to place feet together independently and stand 1 minute safely
( ) 3 able to place feet together independently and stand 1 minute with supervision
( ) 2 able to place feet together independently but unable to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 15 seconds feet together
( ) 0 needs help to attain position and unable to hold for 15 seconds

Berg Balance Scale continued…

REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING
INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)
( ) 4 can reach forward confidently 25 cm (10 inches)
( ) 3 can reach forward 12 cm (5 inches)
( ) 2 can reach forward 5 cm (2 inches)
( ) 1 reaches forward but needs supervision
( ) 0 loses balance while trying/requires external support

PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up the shoe/slipper, which is in front of your feet.
( ) 4 able to pick up slipper safely and easily
( ) 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently
( ) 1 unable to pick up and needs supervision while trying
( ) 0 unable to try/needs assist to keep from losing balance or falling

TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING
INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. (Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.)
( ) 4 looks behind from both sides and weight shifts well
( ) 3 looks behind one side only other side shows less weight shift
( ) 2 turns sideways only but maintains balance
( ) 1 needs supervision when turning
( ) 0 needs assist to keep from losing balance or falling

TURN 360 DEGREES
INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.
( ) 4 able to turn 360 degrees safely in 4 seconds or less
( ) 3 able to turn 360 degrees safely one side only 4 seconds or less
( ) 2 able to turn 360 degrees safely but slowly
( ) 1 needs close supervision or verbal cuing
( ) 0 needs assistance while turning

PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED
INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.
( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds
( ) 3 able to stand independently and complete 8 steps in > 20 seconds
( ) 2 able to complete 4 steps without aid with supervision
( ) 1 able to complete > 2 steps needs minimal assist
( ) 0 needs assistance to keep from falling/unable to try

STANDING UNSUPPORTED ONE FOOT IN FRONT
INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)
( ) 4 able to place foot tandem independently and hold 30 seconds
( ) 3 able to place foot ahead independently and hold 30 seconds
( ) 2 able to take small step independently and hold 30 seconds
( ) 1 needs help to step but can hold 15 seconds
( ) 0 loses balance while stepping or standing

STANDING ON ONE LEG
INSTRUCTIONS: Stand on one leg as long as you can without holding on.
( ) 4 able to lift leg independently and hold > 10 seconds
( ) 3 able to lift leg independently and hold 5-10 seconds
( ) 2 able to lift leg independently and hold ≥ 3 seconds
( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently.
( ) 0 unable to try of needs assist to prevent fall

( ) TOTAL SCORE (Maximum = 56)

FUGL-MEYER ASSESSMENT
LOWER EXTREMITY (FMA-LE)
Assessment of sensorimotor function

ID:
Date:
Examiner:

E. LOWER EXTREMITY

I. Reflex activity, supine position		**none**	**can be elicited**
Flexors: knee flexors		0	2
Extensors: patellar, Achilles		0	2
	Subtotal I (max 4)		

II. Volitional movement within synergies, supine position			**none**	**partial**	**full**
Flexor synergy: Maximal hip flexion (abduction/external rotation), maximal flexion in knee and ankle joint (palpate distal tendons to ensure active knee flexion).	Hip	flexion	0	1	2
	Knee	flexion	0	1	2
	Ankle	dorsiflexion	0	1	2
Extensor synergy: From flexor synergy to the hip extension/adduction, knee extension and ankle plantar flexion. Resistance is applied to ensure active movement, evaluate both movement and strength.	Hip	extension	0	1	2
		adduction	0	1	2
	Knee	extension	0	1	2
	Ankle	plantar flexion	0	1	2
		Subtotal II (max 14)			

III. Volitional movement mixing synergies, sitting position, knee 10cm from the edge of the chair/bed		**none**	**partial**	**full**
Knee flexion from actively or passively extended knee	no active motion no flexion beyond 90°, palpate tendons of hamstrings knee flexion beyond 90°, palpate tendons of hamstrings	0	1	2
Ankle dorsiflexion compare with unaffected side	no active motion limited dorsiflexion complete dorsiflexion	0	1	2
	Subtotal III (max 4)			

IV. Volitional movement with little or no synergy, standing position, hip at 0°		**none**	**partial**	**full**
Knee flexion to 90° hip at 0°, balance support is allowed	no active motion / immediate and simultaneous hip flexion less than 90° knee flexion or hip flexion during movement at least 90° knee flexion without simultaneous hip flexion	0	1	2
Ankle dorsiflexion compare with unaffected side	no active motion limited dorsiflexion complete dorsiflexion	0	1	2
	Subtotal IV (max 4)			

V. Normal reflex activity supine position, evaluated only if full score of 4 points achieved on earlier part IV, compare with unaffected side				
Reflex activity knee flexors, Achilles, patellar	0 points on part IV or 2 of 3 reflexes markedly hyperactive 1 reflex markedly hyperactive or at least 2 reflexes lively maximum of 1 reflex lively, none hyperactive	0	1	2
	Subtotal V (max 2)			
	Total E (max 28)			

F. COORDINATION/SPEED, supine, after one trial with both legs, blind-folded, heel to knee cap of the opposite leg, 5 times as fast as possible		**marked**	**slight**	**none**
Tremor		0	1	2
Dysmetria	pronounced or unsystematic slight and systematic no dysmetria	0	1	2
		> 5s	**2 - 5s**	**< 1s**

Time	more than 5 seconds slower than unaffected side 2-5 seconds slower than unaffected side maximum difference of 1 second between sides	0	1	2
	Total F (max 6)			

H. SENSATION, lower extremity blind-folded, compared with unaffected side		**anesthesia**	**hypoesthesia dysesthesia**	**normal**
Light touch	leg foot	0 0	1 1	2 2
		absence, less than 3/4 correct	**3/4 correct considerable difference**	**correct 100% little or no difference**
Position small alterations in the position	hip knee ankle great toe (IP-joint)	0 0 0 0	1 1 1 1	2 2 2 2
	Total H (max12)			

J. PASSIVE JOINT MOTION, lower extremity					**J. JOINT PAIN** during passive motion, lower extremity		
compare with unaffected side		only few degrees	decreased	normal	pronounced constant pain during or at the end of movement	some pain	no pain
Hip	Flexion	0	1	2	0	1	2
	Abduction	0	1	2	0	1	2
	External rotation	0	1	2	0	1	2
	Internal rotation	0	1	2	0	1	2
Knee	Flexion	0	1	2	0	1	2
	Extension	0	1	2	0	1	2
Ankle	Dorsiflexion	0	1	2	0	1	2
	Plantar flexion	0	1	2	0	1	2
Foot	Pronation	0	1	2	0	1	2
	Supination	0	1	2	0	1	2
Total (max 20)					**Total** (max 20)		

E. LOWER EXTERMTY	/28
F. COORDINATION / SPEED	/6
TOTAL E-F (motor function)	/34

H. SENSATION	/12
J. PASSIVE JOINT MOTION	/20
J. JOINT PAIN	/20

ANNEXURE - VI

TREATMENT PROTOCOL

GROUP A- PNF D1 FLEXION &EXTENSION PATTERN

TREATMENT DURATION PER SESSION: One time per day,

- PNF pattern isometrically at final position and after application PNF pattern isotonically.

1.FLEXION PATTERN OF LOWER LIMB

(Flexion-Adduction-External Rotation)

- **Starting Position**: Toes flexed and foot is in planter flexion, eversion, knee flexion, hip is in extension, abduction, internal rotation.
- **Command:** "Foot and toes up and in; bend your knee; pull your leg over and across."
- **End Position:** The hip is in flexion, adduction, external rotation, knee extension, foot dorsiflexion and inversion, toes extension.

❖ **Starting position**

❖ **Isotonic contraction**

❖ **Isometric contraction**

2.EXTENSION PATTERN OF LOWER LIMB

(Extension – Abduction-Internal Rotation)

- **Starting Position**: Toes extended, foot dorsiflexed and inverted, knee extended and hip is in flexion, adduction, external rotation.

- **Command:** "Push your foot down and kick down and out." "Kick!

- **End Position:** The hip is in extension, abduction, internal rotation, knee extended, foot is in planterflexion, eversion and toes flexed.

- **Rest time:** 5min/each sets

- **Repetition**: Isometric at end range- holding 3-4 sec/ repeated 3times
  Isotonic throughout the ROM- 3 sets /10 repetitions

❖ **Starting position**

❖ **Isotonic & Isometric contraction**

GROUP B- PNF D1 FLEXION PATTERN

TREATMENT DURATION PER SESSION: One time per day,

- PNF pattern isometrically at final position and after application PNF pattern isotonically.

FLEXION PATTERN OF LOWER LIMB

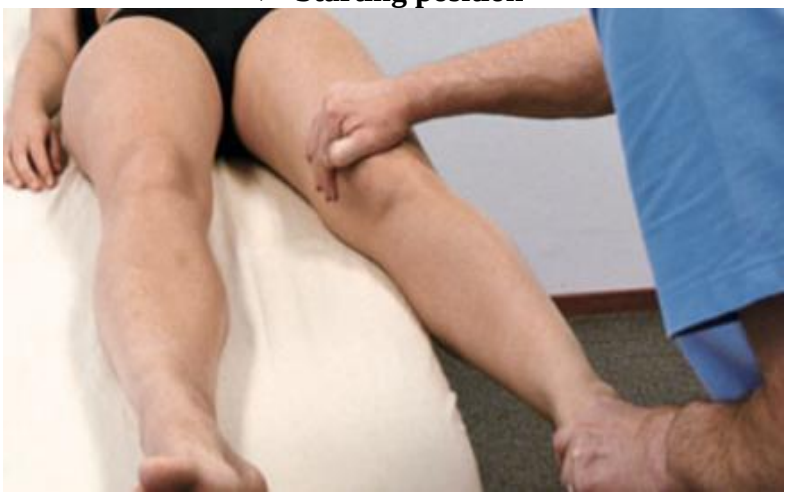
(Flexion-Adduction-External Rotation)

- **Starting Position**: Toes flexed and foot is in planter flexion, eversion, knee flexion, hip is in extension, abduction, internal rotation.
- **Command:** "Foot and toes up and in; bend your knee; pull your leg over and across."
- **End Position:** The hip is in flexion, adduction, external rotation, knee extension, foot dorsiflexion and inversion, toes extension.

- **Rest time:** 5min/each sets

- **Repetition**: Isometric at end range- holding 3-4 sec/ repeated 3times
  Isotonic throughout the ROM- 3 sets /10 repetitions

❖ **Starting position**



❖ **Isotonic contraction**

❖ **Isometric contraction**

GROUP C- PNF D1 EXTENSION PATTERN

TREATMENT DURATION PER SESSION: One time per day,

- PNF pattern isometrically at final position and after application PNF pattern isotonically.

EXTENSION PATTERN OF LOWER LIMB

(Extension – Abduction-Internal Rotation)

- **Starting Position**: Toes extended, foot dorsiflexed and inverted, knee extended and hip is in flexion, adduction, external rotation.
- **Command:** "Push your foot down and kick down and out." "Kick!
- **End Position:** The hip is in extension, abduction, internal rotation, knee extended, foot is in planterflexion, eversion and toes flexed.
- **Rest time:** 5min/each sets
- **Repetition**: Isometric at end range- holding 3-4 sec/ repeated 3times
  Isotonic throughout the ROM- 3 sets /10 repetitions

❖ **Starting position**

❖ **Isotonic & Isometric contraction**

ABSTRACT

EFFECT OF LOWER LIMB IRRADIATION BY PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON BALANCE IN STROKE PATIENTS.

BACKGROUND – Stroke is a global health problem. It is the second commonest cause of death and fourth leading cause of disability worldwide. Stroke or Cerebrovascular accident [CVA]) is the sudden loss of neurological function caused by an interruption of the blood flow to the brain. Proprioceptive neuromuscular facilitation (PNF) is a concept of treatment widely used in rehabilitation to improve the performance of the neuromusculoskeletal system through the stimulation of muscle and joint proprioceptors.

OBJECTIVE– To find out the effectiveness of PNF training on contralateral lower extremity on balance in stroke patients.
DESIGN– Prospective Quasi-Experimental Design.
SETTING – Department of Neurology & Department of PMR, PSG Hospital, Coimbatore.
PARTICIPANTS- A total of 30 stroke patients in the age group of 40 to 65 years participated in the study. The participants who satisfied the selection criteria were selected by simple random sampling and assigned into three groups.

- Group A- 10 patients will received contralateral PNF D1 flexion &extension pattern.
- Group B- 10 patients will received contralateral PNF D1 flexion pattern.
- Group C- 10 patients will received contralateral PNF D1 extension pattern.

INTERVENTIONS – Group A received contralateral PNF D1 flexion &extension pattern ,Group B received contralateral PNF D1 flexion pattern and Group c received contralateral PNF D1 extension pattern for 12 days [6 sessions per week for 2 weeks (45minutes/session)]
OUTCOME MEASURES –1.Berg Balance Scale score 2. Fugl- Meyer Assessment score.

RESULTS – The statistical analysis shows improvement in both outcome measures. In BBS measure the mean difference of pre test and post test score for Group A was 1.600, Group B was 0.700 and Group C was 0.700. The 't' value calculated by using paired 't' test for Group A, Group B and Group C were 7.236, 4.583 and 3.280 respectively, which was less than the 't' table value 2.262 ($p<0.05$). According to the calculated one way ANOVA shows statistically significant difference between three groups ($F= 7.640$ $p<0.05$) in BBS. And post hoc analysis in homogenous subsets of BBS shows there was a significant difference among all three groups.
In FMA-LE measure the mean difference of pre test and post test score for Group A was 1.600, Group B was 0.600 and Group C was 0.700. The 't' value calculated by using paired 't' test for Group A, Group B and Group C were 9.798, 2.250 and 1.964 respectively, which Group A was less than the 't' table value 2.262 (p 0.05) Group B and Group C was greater than the 't' table value. According to the calculated one way ANOVA shows statistically significant difference between Groups is $F= 7.000$ (p 0.05) . And post hoc analysis in homogenous subsets of FMA-LE shows there was only a significant difference in Group A than Group B and C.

CONCLUSION – The results of these statistical analysis showed that the PNF D_1 flexion and extension was effective than PNF D_1 flexion and PNF D_1 extension irradiation on contralateral side improving balance and muscle activity.

Keywords: Irradiation, Proprioceptive Neuromuscular Facilitation, Balance